VIRGINIA GIS REFERENCE BOOK

General Application Category/Sub Application Name: Economic Development

Product /Service/Function Name: Site Location and Evaluation

P/S/F/ Description: An application to allow local economic development partnerships and entities to help their customers evaluate and locate sites that may accommodate special needs for businesses that may possibly relocate them into the area. Allows for quick dissemination of information to business prospects in an interactive and dynamic manner that includes evaluation and analysis functions to better serve possible users.

Product /Service/Function

1. Spatial Data:

Spatial Data is information about the location and shape of, and relationships among geographic features, usually stored as coordinates and topology. In general terms, spatial data is a term given to digital information that contains a geographic component.

The most basic format of spatial data is typically in the form of "shape" file (ESRI file format), or a DWG file (AutoCad file format). These file formats are, for the most part, standards in the GIS industry. This spatial data can be presented within certain software packages in varying degrees of formatting, such as coverages, themes and projects. Spatial data is usually categorized in two ways. Vector spatial data are typically point, line, polyline, or polygon shapes depicting objects or features. Raster spatial data are typically imagery-based data such as orthophotography or image based generated such as digital raster graphics. Raster imagery is typically used as a base layer or frame of reference layer.

- Minimum Requirements: At a minimum, a functioning application that provides a basic level of useful information to the target users will need to have spatial data layers of geographically referenced point locations for available buildings and polygon areas for available sites within the region. Additionally, spatial data for site analysis and evaluation would need could include framework data layers such as railroads, roads, hydrology, utilities, environmental boundaries, easements, airports and schools, water, sewer, to name a few. These additional framework data layers will be required, where feasible to perform useful site location, selection and evaluation functions.

  At least one base spatial data layer will be needed to provide a frame of reference for the desired region. The VBMP orthophotography product will be an excellent base spatial layer that can be utilized. If the above spatial layers are not already compiled then they will need to created or developed using standard GIS data

collection and development processes. All spatial data will need to be in the same coordinate system, projection and file formats.

- Optional Requirements: Building footprint polygons could be generated instead of points. Additional spatial data layers will enhance the overall usefulness of the GIS. Optional spatial base map layers such as digital raster graphics (DRGs) from the USGS or digital elevation model graphics (DEMs) may be added as base map layers in order to convey additional information to the user.

2. Attribute Data

Attribute data are characteristics of a geographic features described by numbers, characters, images or drawings, typically stored in a tabular format and linked to the feature by a user-assigned identifier. In most basic terms, attribute data are tabular data in a database structure that link to and hold additional information about corresponding spatial data.

Attribute data will generally be in two forms. One form will be tabular data in a ".dbf" file format which is a component of the ESRI shape file set. These spatial data are typically and best limited to unique identifier column and columns that hold pertinent spatial information such as latitude/longitude information or X/Y positions. Additional attribute information should be housed in a separate typical database structure (ASCII text file, spreadsheet, database) that ties to the unique identifier of the records in the shape file "dbf". These data can contain all additional information that is needed or desired to convey information about a particular spatial element. All data structures and naming conventions should be in standard ANSI formats.

- Minimum Requirements: At a minimum, typical real estate type data should be collected for all sites and buildings being offered. Typical data to be collected for sites will include square feet of facility, facility use, address, special features, utilities and telecommunications, taxes, zoning, characteristics, acreage of property, easements, address/location, zoning, topology indicator, road or water frontage, taxes, utilities and telecommunications available at site. Additional data will need to be provided for an application to function as a useful site evaluation tool. Additional data would include special or unique features of sites and/or building such as ceiling heights, dock facilities, special utilities, cranes, distances to hi-ways, interstates, airports, waterways and railroads. The list of possible types of data that can be collected and offered in a system, however, data collection and development should be based on a prior needs analysis and assessment work. Demographic data should be included for the region that an application will encompass. Both building and site data should include contact information for additional information requests.

- Optional Requirements: Optional attribute information can be almost infinite in scope. These attributes may include private information not used for public consumptions such as price of building or site, realtor comments, repair histories, past ownership and tax assessments to name a few. This may include buying highly targeted and processed data from third party data providers. Environmental impact studies, evaluations and easement information should be collected where and when feasible.

3. Data Acquisition Options (integrated with VBMP digital orthos):

Data acquisition will basically be divided into two categories for an organization. The first is to collect and develop data "in-house." Another category is acquiring data that have already been developed. Where possible, acquiring data that have already been developed will be the desired model. Spatial data collection will need to done with the use of field personnel and GPS equipment or possibly a survey team. Spatial data acquisition should be conducted by utilizing the wealth of spatial data resources currently available at various local, state and national levels. This includes, but is not limited to, the Virginia Geographic Information Network (VGIN), The Virginia Economic Development Partnership (VEDP), and the USGS. For an economic development application, the majority of framework data layers will be available from VEDP which has devoted substantial resources to amass an extensive collection of spatial data that may be of importance to economic development efforts for any locality.

Tabular or attribute data collection will be handled best by performing research and compiling data. This will include data entry for information attributes to be used within the system. Possible sources of information collection could include local and regional MLS records, zoning records, tax records, and other publicly available data concerning buildings and sites within the region. Environmental impact studies, evaluations and easement information should be collected where and when feasible.

The VBMP digital orthophotography will be one of the best sources for the spatial base map layer. This will be available through arrangements with the Virginia Geographic Information Network. Other possible base map layers may include raster spatial data from the VEDP and USGS.

4. Data Conflation Options (integrated with VBMP digital orthos):

Conflation is the method whereby a geographic feature is adjusted to fit a more accurate base map. This process can occur in variety of ways, with the least sophisticated being a "best-fit" methodology. The best-fit method is a visual inspection or comparison of a geographic feature's current position to where it is or should be located on the more accurate base map.

Another conflation option includes rubber sheeting, a method using control points or existing boundaries to establish the new geographic position of a feature.

Finally, the most accurate method of conflating data includes the use of Global Positioning Satellite technology (GPS), or traditional survey instruments to accurately locate an objects physical location.

5. GUI / Programming Options:

A GUI or graphical user interface is a graphical method of controlling how a user interacts with a computer to perform various tasks. Instead of issuing commands at a prompt, the user performs desired tasks by using a mouse to choose from `a dashboard' of options presented on the display screen. These are in the form of pictorial buttons (icons) and lists. Some GUI tools are dynamic and the user must manipulate a graphical object on the screen to invoke a function; for example, moving a slider bar to set a parameter value (e.g., setting the scale of a map).

There are two main avenues to develop an application and GUI for your GIS data. An application can be standalone or distributed.

Standalone applications are typically built by programming modules, scripts and add-ins to perform specific analyses that are extensions of desktop GIS software packages such as ArcView, ArcInfo or AutoCAD.

Another desktop method would be to program a GUI and application from scratch utilizing a programming language and suite such as MS Visual Basic, FoxPro or C++ and a third party GIS programming suite such as ESRI Map Objects. Workstation based or standalone applications are usually developed to perform specific higher-end functions for a user that has a working knowledge of GIS systems.

Typically a distributed application will be shared across an Intranet or the Internet with the user utilizing a thin client such as a browser. An Internet based application will typically utilize a mix of languages to create a finished product. These languages can include HTML, Java, JavaScript, XML, AXL, Pearl, PHP, JSP, Cold Fusion or MS ASP. Specific knowledge a map server software package such as ESRI's ArcIMS or AutoCAD's MapGuide will be required.

On either the standalone option or the distributed method, there are certain functions that an evaluation application will need to encompass. Features and functions such as a tool to measure distance on the map, a tool to buffer attribute/objects from one layer to select objects/attributes from another layer, a tool to select by polygon and a tool to select by line.

6. Internet Functionality and Options

Internet delivery and functionality would be very important to this application. One of the goals of economic development entities is to attract new business and industry into the region. Providing a site and building inventory application over the Internet that is accessible to all potential and prospective companies that are looking for a location is

crucial. Internet functionality should include basic GIS functions available in a thin client GIS application, such as ESRI's ArcExplorer (i.e. Zoom In, Zoom Out, Pan, Identify, Query, Thematic Mapping, etc.). Additionally, the application will want to incorporate functions listed in the "GUI Programming Options" section above.

Additional functionality may include appropriate hyperlinks to critical and related information on the Internet that may be related to certain queries or operations within the application. A dedicated "needs based" approach to determine user interface options and functionality is highly recommended before actual application work is to begin. There are many Internet based map server technologies available on the market today and great care should be taken to evaluate the different options when selecting the software and programming language option that will be utilized for your application.

7. Technical Requirements

Technical requirements will vary greatly depending on whether the application programming, development and hosting functions are in-house or if the functions are outsourced to a GIS applications development and hosting firm. Obviously, the situation that would require the least amount of technical requirements and resources would be to outsource to a firm that already has all the technical requirements and experience in place. However, for the purposes of this paper, we will assume that all of the development and hosting will occur in-house. Some of the resources listed below may already be within the existing pool of resources at some organizations.

- Minimum: The application should be developed on a dedicated development computer. A dedicated development computer is important since during the development process it is often necessary to reboot the computer and try different configurations on a regular basis which would adversely affect any other uses of the computer. When it is time to serve the application out to an audience, it is recommended that a dedicated production server be implemented. This will insure that other organizational applications, and uses do not interfere with the operation of the map server.

  If the application it to be a distributed or shared application, additional hardware will be needed as a byproduct of serving the application to multiple users. For an Intranet application you will need all of the typical hardware in a network environment including (cabling, hubs, switches, network card, etc.). If the application is to be distributed over the Internet then hardware requirements will be expanded to include a CSU/DSU, router, and possibly a firewall appliance. If dedicated high-speed Internet access is not already in place, then it will need to be installed.

  Required software will include an operating system software package, a web server software package, map server software package, a middleware software package, and back-up software package, enterprise level database software

package, programming editor software package, and a mid-level desktop GIS software package.

- Optimum: The main difference between minimum technical requirements and optimum technical requirements will be mainly in redundancy in hardware and connectivity areas. Another optimal situation is to have higher-end machines with multiple processors and large amounts of memory. Multiple processors, in most cases, will increase software costs a considerable amount. If performance and high application traffic are going to be issues, then a clustered server environment should be considered.

8. Administrative / Management Requirements

Management concerns will involve technical support, system maintenance and, of course, human resource management issues of a technical product. These issues are minimal if the maintenance and hosting of the application are contracted to a GIS application development and hosting organization. Technical and administrative issues become more critical and consuming when developing and/or hosting an application in-house. General expertise in GIS is suggested if outsourcing application development and hosting. In-house application development and hosting will require GIS specialist human resources, advanced web programming human resources, and significant technical material resources (hardware/software).

Management of an economic development site location and evaluation application should be concerned with data development, application development and system maintenance. A manager should be well experienced in project management regarding technical resources, human resources and multi-faceted disciplines.

The data required for this application typically exists at the state or local levels. The manager must be tasked with obtaining the necessary data from these respective organizations, and developing a repeatable process for updating/ uploading the information to the specified application data source. The critical process is to link these tabular records to their corresponding geographic feature.

9. Cost – Cost/Benefit

The cost of developing a sites and buildings inventory application could range from $65,000 to $120,000 depending upon the functionality, use, and the outsourcing of components involved. See below for an approximate and general breakdown of costs that may be incurred when developing an application in-house. Please note that the figures below are very general and estimates. The figures below assume that the application development is starting from ground zero and not adding functionality onto a site and buildings inventory application that has already been developed.

Hardware Costs: (Assuming Internet Deployment)

Item	Units	Cost	Total
Development Server	1	2,500	2,500
Production Server	1	5,000	5,000
GPS Units	3	1,000	3,000
Back-up System	1	3,500	3,500
Router	1	2,500	2,500
CSU/DSU	1	500	500
Dedicated Bandwidth	12	1,000	12,000
UPS for Computers	2	250	500
Total			**29,500**

Software Costs: (Assuming single processor based licensing)

Item	Units	Cost	Total
Operating System	1	1,000	2,500
Database Server	1	4,500	4,500
Map Server	1	7,500	7,500
Application Server	1	1,500	1,500
Java Server	1	1,000	1,000
Desktop GIS Package	2	1,500	3,000
Program Editor	1	650	650
Total			**20,650**

In-House Development Human Resource Costs:
(Assuming Internet Deployed Application and 6 month development cycle)

Item	Man/Hours	Utilization over 6 months	Hourly Cost	Total
GIS Specialist/Technician	720	35%	17.5	12,600
Field Personnel/Research	560	24%	15	8,400
Network/System Admin	240	24%	25	6,000
Programmer(s)	1200	100%	35	42,000
Manager	200	14%	25	5,000
Total[1]				**74,400**

On-going Application Maintenance/Enhancements (after development):
(Assuming Internet Deployed Application over 12 months)

Item	Man/Hours	Utilization over 6 months	Hourly Cost	Total
GIS Specialist/Technician	320	15%	17.5	5,600
Network/System Admin	156	7.5%	25	3,900
Programmer(s)	450	22%	35	15,750
Manager	156	7.5%	25	3,900
Total[1]				**29,150**

On-going Application Hosting (after development):
(Assuming Internet Deployed Application over 12 months)

Item	Units	Unit Cost	Total
Dedicated Bandwidth	12	1,000	12,000
Total			**12,000**

[1] Please note that the above human resources are rough estimates of hours for man-hours needed to perform some data collection and data development processes as well as the application development process. If the above human resources are not currently on staff and available for a project of this nature, resources would need to be acquired, most likely on a full-time basis. This is not feasible unless there is sufficient cause and workload to occupy these human resources for the additional hours above the utilization column above.

As indicated from the above estimates, developing the initial application could range in the $100,000 range. On-going maintenance, enhancements and hosting could be in the $45,000 range. Outsourcing the development and hosting functions to a qualified/experienced applications development firm could realistically cut the initial development costs by 50% and cut the ongoing maintenance and hosting costs by 75%.

The cost/benefit is highly favorable. The benefit to the economic development region is somewhat intangible, yet positive in the form of providing improved public and business service and in increasing positive perception of a local government's or region's credibility, innovation and willingness to accommodate new business in the area.

It is likely that an application of this nature, publicly available over the Internet, may introduce the region to a potential business looking to locate an entity or division in the area that otherwise may not have considered the area. The tax base revenues from one such medium sized business may very well pay for the initial development costs.

10. Standards / Guidelines Summary

This application will most likely be used to evaluate more than one specific county or locality since economic development regions typically expand beyond a single locality. Buildings and sites inventory should include available locations beyond a single locality and will require some research and data collection that will involve localities, local realtors, chambers of commerce and others.

All GIS or spatial data should be delivered, collected or developed in a format and projection that matches the VBMP orthophoto base map. The attribute, or tabular data, provided by 3rd party entities should be in a standard database format, spreadsheet format or ASCII delimited text file format.

When and where possible, approach the application development process in phases. This type of application will be very data centric or rely on data a great deal for usefulness to the intended user. Develop a basic database application as a first step and then add the mapping functionality and administrative and "back-end" functions in a later phase. This process will help keep the project manageable and allow for dispersed budgeting.

11. Startup Procedures/Steps

- Application Outline / Blueprint: Application purpose, interface design, functionality, queries and "look and feel" should be determined and documented as an initial step. Stakeholders should be involved in this step.
- Data Acquisition: The attribute data should be obtained from the various sources mentioned earlier and normalized and related where necessary. Spatial data can be downloaded from a variety of sources listed above. If spatial data is not available then it will need to be collected and developed.
- Sourcing Determination: Determine entity/entities that will be performing data development functions, application development functions and application hosting functions and create a project plan with budget numbers.
- Develop a implementation plan that includes timelines and milestones.
- Develop a data development/transformation plan that includes metadata definitions, database schema, and data dictionaries with relational information.
- Readdress your project plan, timelines and budgets as a final initial process before committing resources.
- It is recommended that the database application functions be addressed and implemented before the mapping functions.

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12. Estimated Time Line and/or Implementation (stand alone) schedule

The estimated time to develop this application varies based on functionality. This can be as little as six months, to as much as 18 months. Typically this type of application can be developed in approximately 9 months. Data collection and development functions will add to the timeline. A sample timeline may if offered below as a generic applications development cycle.

Function	**Time**
Data collection/Research	4 months
Data development	3 month
Application Planning/Documentation	2 month
Application development	7 months
Application staging/testing	2 month
Total time line	**18 months**

13. Best Practice Example in Virginia:

The Virginia Economic Development Partnership has implemented one of the best examples of an economic development sites and buildings inventory application for Virginia. The application covers the whole state and has a good bit of framework and base map data available to users. The application can be seen at http://www.yesvirginia.org/vascan.asp. For more information concerning this application please contact Jean Tingler at (804) 371-0340 or jtingler@vedp.state.va.us .